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Minimum Wages, Market Inflexibilities, and Female Employment in Select OECD Countries

Orgul Demet Ozturk*

Abstract

Using international and intertemporal variations in minimum wages, employment protection laws, minimum wage regulations and female work behavior within the OECD, empirical analysis provide evidence that higher minimum wages are associated with lower female labor force participation and employment. This association is more significant in countries with more stringent employment protection laws, lower female tertiary educational enrollment and higher fertility. In addition to the extensive margin analysis, it is shown that minimum wage levels are positively correlated with the ratio of part-time workers. That is, minimum wages are associated with not only lower participation and employment rates among women but also with higher marginalization of female work. This association is stronger in countries with more inflexible labor markets and less active labor market policies. Moreover, existence of a subminimum wage for youths implies further reduction of employment while increasing part-time job incidence for females, when the minimum wage increases.

Keywords: Labor market regulations, female work, minimum wage, OECD, time series data
JEL CODES: J2 J3

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1 Introduction

In this paper, the cross-country differences in minimum wage levels, minimum wage systems and other labor market characteristics are exploited in order to understand the relationship between minimum wages and supply of, and demand for female labor. The main purpose of the paper is to analyze the sensitivity of the relationship between female work characteristics and minimum wages to labor market regulations or rigidities.

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There are numerous studies concentrating on labor market rigidities. The effects of market rigidities on employment, unemployment, hours, and composition of labor input in production are studied before, using international time series data with a variety of measures. Although it is claimed that Employment Protection Laws (EPLs) may increase enterprise adaptation and investment in skills of the employees (Nickell and Layard, 1998; Levine and Tyson, 1990) and the bargaining power of employees in a monopsony environment (Gregg and Manning, 1997), enhance aggregate productivity, living standards, and growth when employment stability is a source for technological innovation, the empirical evidence usually suggests negative effects. EPLs may deepen the gap between insiders (workers who are employed) and outsiders (workers who are not employed). They also raise labor costs and may force firms to reduce employment. Persistent European unemployment rates in the 80s and 90s are the inspiration for most of the work in this literature. Bertola (1990) finds that although EPL does not have a clear effect on unemployment levels, high levels of employment protection contribute to persistence of unemployment. The same year, Lazeer shows that employment and participation are negatively correlated with labor market regulations on firing, such as severance pay, across 22 countries. Nickell (1997) and Blanchard and Summers (1987) show similar results. Market regulations are also shown to explain the increased duration of unemployment in European countries (Boeri, 1999; Blanchard, 2005). These studies also show that EPLs increase job-to-job mobility but reduce all other flows in the labor market, especially for blue collar workers, and increase the non-regulated forms of employment (Grubb and Wells, 1993).

The relationship of the minimum wage and the employment level is modeled within various theoretical frameworks, with no consensus on either the sign or the magnitude. In the standard neoclassical theory, employment will fall if the wage is exogenously raised. Thus, the higher the minimum wage, the more unemployment there will be. Alternative economic models, on the other hand, predict positive or uncertain employment effects. For example, in a monopsony, the employer can set the wages below the marginal product of labor. Thus, imposing a minimum wage in this market will increase the employment (Manning, 2003). We can observe positive employment effects if higher minimum wages increase the incentives for low-productivity workers to invest in human

capital (Cahuc and Michel, 1996) or firms to provide more training (Acemoglu and Pischke, 1998) - higher human capital increases the productivity and consequently the employment level.

The direction of the employment effect of the minimum wage becomes indeterminate if the minimum wage affects labor demand elasticities over time, (Rebitzer and Taylor, 1995) or as in a search model the level of minimum wage has an impact on job search intensity, and the probability of receiving job offers. In a model where workers and jobs are heterogeneous, time is needed to ensure that each worker's type matches its own job type. The effect of setting a minimum wage in this context is to increase the reservation wage and therefore the quality of the match between jobs and workers' profile. Other theoretical settings predict insignificant effects noting that firms can respond to an increase in the real minimum wage by making working conditions harder (Fraja, 1999). It is also been noted that in most countries indexation of the minimum wage is not automatic- for example, the USA- which enables increases in average wages and inflation to erode its relative importance (Kennan, 1998).

As with the theoretical predictions, empirical evidence varies and fails to reach a consensus on the sign and extent of the relationship between employment and minimum wages. Card and Krueger (1995) point out in their well-known study that firms can adjust in a variety of ways to moderate increases in minimum wages, for example by reducing non-wage benefits, offering less training on the job, etc. Their study reports that minimum wages have no effect on employment and show that estimation techniques exaggerated the economic significance of the negative employment effects in previous studies. Bernstein and Schmitt (1998) and Machin and Manning (1994-for UK), Manning (1996), Dickens et al (1999) also report similar results on this issue.

Minimum wage studies rarely document an economically significant effect on employment, either positive or negative, mostly because minimum wage is rarely binding in many of the economic environments studied. Besides, many of these studies are concentrated on the impact on low-wage employment, especially teenage employment (see, for example, Brown et al, 1982; Deere et al., 1995 and Neumark and Wascher, 1995), so the subject of these studies are rarely the major source of labor supply. In this paper I include a minimum wage measure which will take the bite of the minimum wage into account and also inflexibility measures for the labor markets. Many OECD and ILO reports provide international evidence suggesting that in inflexible environments minimum wage regulations make it difficult for new workers, especially the low ability ones, to price themselves into the labor market and may have significant employment effects. Moreover, as shown by Ozturk (2006), in inflexible markets the minimum wage not only affects employment through productivity levels but also may change the distribution of available jobs. Thus, all groups of workers may be affected.

The lack of clear evidence on the relationship between current minimum wages and the employment levels motivated researches to concentrate on the long run effects of minimum wages.

Neumark and Nizalova (2004) show that individuals who were exposed to higher minimum wages in their teenage years have decreased labor market experience and tenure lower current labor supply due to lower wages and limited training and skill acquisition. They estimate the long run effects and show that it may be misleading to look at immediate effects of minimum wage changes on employment since these analysis may exclude potentially very significant components of effects of minimum wages. Cunningham (1981), Ellwood (1982), Ehrenberg and Marcus (1982), Meyer and Wise (1983) are earlier papers with similar conclusions. These papers suggests that higher minimum wages may lower training among young workers, reduce the accumulation of labor market skills by reducing their chance of employment, and discouraging school enrollment and thus may have significant long run effects which cannot be observed in cross-sectional analysis. For example Meyer and Wise(1983) show that the employment would be 7% higher among 16-to-19-year-olds, 2% higher among 20-to-24-year-olds if they were not exposed to minimum wage. Their estimates suggest that effects are stronger for black youth. They also showed there is no evidence that the negative employment effects of minimum wages are offset by positive effect on earnings.

As mentioned before, there is not much in minimum wage literature about segments of labor force other than the teenagers. Moreover, most of the evidence comes from North America and UK. Laroque and Salanie (1999) is among the exceptions. Using a updated version of Meyer and Wise (1983) method they identify how much of the unemployment can be explained by the existence of the minimum wage after controlling for factors causing business cycle frictions. They show that at least ten percent of unemployment among married French women is due to the fact that the employers are not willing to hire these women for the implied minimum wage.

The next section describes the data. The third section presents the empirical model and results. Section four concludes with a discussion of the findings.

2 Data

The data used in this analysis are gathered from OECD online database and published resources.¹ It include information on employment and unemployment rates, labor force participation rates, share of part-timers among female workers, adult male unemployment rates (as a business cycle control), minimum wages, labor market rigidity measures, minimum wage rules, fertility rates and educational attainment for women. Data on minimum wages are available from the OECD for countries where a national minimum wage is set by statute or by national collective bargaining agreement. For countries where no national minimum exists, but where industry- or occupation-specific minimums are set by legislation or collective bargaining agreements, I use summary estimates constructed by

¹I am grateful to Neumark and Wascher for providing me with the data they use in their analysis. Some of the variables come directly from their data set

Dolado et al. (1996) as my base measure following Neumark and Washer (2004). The estimates Dolado et al uses are the ratio of minimum wages to average wage, while OECD reports the minimum to median wages as the minimum wage measure. I adjusted these rates by using the median to mean wage ratios provided by OECD whenever available. This measure is used instead of real minimum wage levels in order to control for the "bite" of the minimum wage.

All OECD countries have some sort of a minimum wage policy; in 21 of these countries the minimum wage is set by statute and in others (Including Germany, Italy, Austria and Scandinavian countries) it is set by collective bargaining. I use data from 18 of these countries (all of the countries listed in Table 1, except Turkey is used in the analysis. Luxembourg data lack information on market regulations, thus is not used in that portion of the analysis). These countries differ not only in terms of the level of minimum wages but also in terms of the rules governing the determination and coverage of the minimum wages.

Country	1980s	2000s	Method for Setting	Level	Youth Sub-minimum
Italy	0.78	0.71	Negotiated	Industry	Some
France	0.57	0.60	Statute	National	Limited, <18
Australia	0.61	0.56	Statute	National	<21
Germany	0.60	0.58	Negotiated	Industry	Some
Denmark	0.59	0.54	Negotiated	Industry	<18
Ireland		0.38	Statute	National	<18, <18+1, <18+2
Greece	0.69	0.48	Negotiated	National	No
Sweden	0.52	0.51	Negotiated	Industry	<24
Belgium	0.58	0.46	Negotiated	National	<21
Luxembourg	0.41	0.53	Statute	National	<20
Netherlands	0.64	0.52	Statute	National	<23
New Zealand	0.57	0.45	Statute	National	<20
Canada	0.52	0.41	Statute	Provincial	No
United Kingdom	0.43	0.44	Wages Councils	Industry	<21
Portugal	0.48	0.44	Statute	National	<18
Turkey	0.39	0.44	Statute	National	<16
United States	0.47	0.33	Statute	National, State	Limited
Japan	0.29	0.31	Statute	Prefecture	No
Spain	0.48	0.29	Statute	National	<18

First two columns of Table 1 has the minimum to median wage levels from two points in the data, first column is early 1980s (earliest available year differs for each country) and second column is early 2000s (latest available for each country). It shows that in all countries except for France, Luxembourg and Japan, minimum wage to median wage ratios declined over time. European countries generally have higher minimum wage to median wage ratios relative to non-European countries including the United States. This fact has been presented before in the literature, with more general labor market regulation measures, as an explanation for high unemployment rates in Europe.

The last three columns of Table 1 summarise the minimum wage rules. The first of these three columns states how minimum wages are determined. “Negotiated” means that the minimum wage is set as a result of negotiations between government and unions or employers, “Statue” means it is set by law, and “Wages Council” is the name of the council responsible for setting the minimum wage for industries in UK prior to 1993. The fourth column of the first table (or second of the last three) shows if the minimum wage is national or varies across industries and regions. For example, in Japan, the minimum wage varies across prefectures. The last column shows if there are any subminimum wages for the youth and if there are, below what age they apply. In Italy, there is no general subminimum wage for the youth, but some industry agreements also include provisions regarding youth wages. In France, limited youth subminimum wage rates are applicable to workers under the age of 18; 16-year-old workers can be paid 80 percent of the adult minimum, while 17-year-old workers can be paid 90 percent of the adult minimum for six months. In the US, subminimum wages can only be paid to selected full-time students and newly hired workers for up to 90 days. In the UK, currently, workers under 18 are exempt from the minimum wage and workers between ages 18 and 21 can be paid 85 percent of the adult minimum. However, before 1993, time period I have the minimum wage data for UK (there was no minimum wage between 1993 and 1999), minimum wages varied significantly across industries and ages and beginning from 1986 all workers under 21 were exempt from the minimum wage. In Ireland, a national minimum wage policy was established in 2000 and this minimum is 30% lower for workers less than 18 and 20% for the workers in the 1st year of employment after they turn 18 and 10% lower for their second year of employment after they turn 18. (OECD, 1998 and Neumark and Washer (2004) provide great details on minimum wage systems in all OECD countries)

There are also significant differences in terms of labor market regulations, socio-demographics, and female labor market activity among these countries. Table 2 (on the next page) gives a summary of levels and trends of employment protection laws, labor market policies, unemployment insurance, unionization and female labor force participation, employment, unemployment rates and ratio of part-timers among female workers. This table also includes information on educational attainment and fertility rates, since these two are expected to be the two main sociodemographic determinants of labor supply of women. Changes in the female labor force participation rates are consistent with the general worldwide trend. Participation increases in all of the countries over the 26 year period. However, the levels of participation rates vary quite a bit. For example, Italy, Spain, Turkey, and Greece have significantly lower participation rates at any point in time compared to other countries, especially northern European countries like Finland, Denmark, Norway and Sweden. Participation rates is one of the margins included in the analysis since minimum wages together with market inflexibilities may inhibit the low productivity workers from entering to the market, or actively searching when they are unemployed if they think they won’t be offered any jobs.

Table 2: Select Labor Market and Labor Force Characteristics

	Enrollment in tertiary education(as a percent of men) (2005)	Employment Protection Index (1998)	Employment Index (2003)	Fertility		Employment to Population Ratio		Labor Force Participation		Unemployment Rate		Share of Part-timers	
				(1980)	(2004)	(1980)	(2006)	(1985)	(2006)	(1980)	(2006)	(1990)	(2006)
Australia	80	1.20	1.20	1.94	1.77	50.30	71.38	57.26	70.54	6.40	4.88	37.19	35.39
Austria	54	2.22	1.89	1.62	1.42	68.94	77.04	71.66	76.33	3.8	3.59	24.03	28.01
Belgium	69	2.22	2.22	1.68	1.64	45.83	70.79	57.10	73.17	15.34	7.39	34.33	36.70
Canada	70	0.80	0.80	1.68	1.53	55.89	77.07	68.62	78.49	9.72	5.78	20.82	19.73
Czech Republic	42	1.89	1.89	2.1	1.23	71.80	77.56	73.68	77.99	2.56	3.04	46.36	45.25
Denmark	87	1.39	1.39	1.55	1.78	76.81	81.67	84.54	84.29	8.92	4.67	24.08	16.31
Finland	98	2.11	2.00	1.63	1.8	79.76	79.69	86.88	85.05	3.24	8.79	7.18	8.65
France	63	3.00	3.00	1.95	1.91	59.80	73.35	68.90	78.36	9.42	11.13	21.67	24.09
Germany	100	2.50	2.22	1.56	1.36	54.49	72.68	59.21	76.94	7.44	7.45	35.63	35.86
Greece	86	3.50	2.78	2.21	1.29	40.06	60.57	47.76	61.71	8.69	14.70	13.44	10.81
Hungary	70	1.30	1.50	1.92	1.28	70.18	67.60	76.16	70.48	7.85	5.04	3.64	3.89
Iceland	79			2.48	2.04	80.81	83.77	82.99	88.15	2.64	2.45	38.91	28.95
Ireland	66	0.90	1.11	3.25	1.93	30.29	68.05	37.11	65.03	16.79	3.62	24.36	32.47
Italy	72	2.72	1.89	1.64	1.33	37.14	59.25	47.87	57.93	10.05	12.05	21.16	25.98
Japan	51	2.00	1.80	1.8	1.29	55.53	66.61	60.33	66.49	2.45	4.38		
Korea	67	2.00	2.00	2.83	1.16	46.97	59.97	48.43	57.79	0.91	3.03		
Luxembourg	13			1.49	1.7	39.26	68.36	43.17	64.86	3.63	2.86	23.02	30.29
Mexico	23	3.11	3.11	4.71	2.2	36.77	49.96	38.22	45.37	3.79	2.38	21.63	17.29
Netherlands	62	2.11	2.11	1.6	1.73	35.58	75.14	44.43	72.72	9.39	3.30	55.47	56.20
New Zealand	74	0.90	1.50	2.12	2.01	65.50	74.42	67.81	73.72	3.68	4.64	34.00	31.14
Norway	98	2.72	2.61	1.72	1.83	67.82	81.03	75.78	83.53	2.56	2.26	36.92	28.40
Poland	72	1.50	1.70	2.28	1.23	67.74	65.30	78.36	76.49	13.54	15.96	11.32	13.44
Portugal	65	3.72	3.50	2.18	1.4	50.23	75.26	63.36	77.28	8.72	4.38	13.81	8.76
Slovak Republic	40	2.39	1.89	1.31	1.24	71.69	70.25	81.12	82.91	11.62	15.78	4.32	2.59
Spain	72	2.89	3.11	2.2	1.32	28.45	63.68	35.09	62.84	16.28	18.89	10.84	15.45
Sweden	100	2.22	2.22	1.68	1.75	81.46	81.52	88.89	85.57	1.94	4.54	25.14	17.76
Switzerland	45	1.11	1.11	1.55	1.42	79.60	74.51	83.4	81.79	4.46	9.86	3.93	3.62
Turkey	24	3.78	3.72	4.63	2.21	33.87	26.61	35.48	28.95	7.14	4.59	12.89	6.07
United Kingdom	70	0.60	0.70	1.84	2.05	68.20	74.86	67.73	76.15	9.53	4.00	42.37	37.82
United States	96	0.20	0.20	1.9	1.76	60.14	72.50	69.62	76.72	6.18	3.27	21.31	18.78
correlation with the lagged minimum wage				-0.16				-0.14		-0.06		0.19	
correlation with the change in minimum wage				-0.004				0.02		-0.08		0.03	

Employment to population ratios rise significantly in all countries except Turkey, Poland, and Hungary where it drops significantly and in Sweden, Finland and Slovak Republic where it does not change by much. Levels of employment to population ratio vary a lot within the OECD, between 27% (Turkey) and 84% (Iceland). Unemployment Rates show the most variance over the data years, even though in early 2000s they are close to their 1980s values, most European countries experience very high unemployment period during late 1980s and 1990s. Highest unemployment rate is 19 percent (Spain) and lowest is 2.3% (Norway), in the reported years. However, in the data female unemployment rate goes up to 29% over the whole data period (Spain, 1994)

Another important dimension of female work is the prevalence of part-time jobs. The last couple columns of the second table illustrates that a significant proportion of working women hold part-time jobs; on average about 25% of all female workforce is in part-time jobs. The share of part-timers ranges from 2.5% (Slovak Republic) to 56% (Netherlands). There is no clear pattern of temporal change in the data; In some countries there is an increase while in some other the ratios either have not changed or have decreased over time. I am interested only in the dependent part-time employment since this is what is affected by market inflexibilities and institutional characteristics. Ozturk (2006) shows how minimum wages can affect the distribution of hours for the jobs offered in the presence of market inflexibilities. If women have to make a choice between home production and long working hours, this relationship is quite important in order to understand female work behavior.

Fertility rates decline significantly in all countries over the course of the data period except in Norway, United Kingdom, Netherlands and Sweden. In 1980s on average fertility rate is 2.1 kids per women cross all OECD countries. In 2004 this average drops down to 1.6. I use female enrolled in tertiary education as a percentage of male enrollment as an indicator of female literacy and gender equality. OECD countries are quite different from each other in this dimension. Table 2 gives the figures for 2005, which range from 21%(Turkey) to 89% (United States)

In the analysis, I also use measure of strength and extend of several other labor market policies. These are same as the measures used in Newmark and Wascher (2004). The first of these is an aggregate indicator of the stringency of regulations governing working time, fixed-term contracts, and employees' representation rights measured as of 1993. The second indicator, which is from 1989, captures the ease of firing and hiring. The third indicator measures the strength and extent of employment-promoting labor market policies. It is measured as the percent of GDP spent by the public sector in 1995 on three types of labor market programs: public employment services, labor market training, and employment subsidies. In addition to these three indices I use a measure of the gross benefit replacement rate for unemployment insurance developed by the OECD and estimates of union density calculated by Nickell and Nunziata (2001). These two measures are also same as the measures used in Neumark and Washer (2004).

3 Empirical Analysis

I adopt a simple empirical model, which has the following general form

$$Y_{it} = \beta MW_{it-1} + X_{it}\Gamma + \delta MW_{it}X_{it} + \epsilon_{it}, i = 1, \dots, I = 18; t = 1, \dots, T = 27$$

where Y_{it} is the female participation rate, the unemployment rate, employment rate or the ratio of part-timers among female workers. On the other side of the equation, MW_{it-1} is the minimum wage to median wage ratio in country i for year $t - 1$, X_{it} are the labor market characteristics, gender related social measures, dummy variables regarding differences in minimum wage regulations, and indices for different labor market inflexibility measures.

I first estimate the above model on our data, treating it as a pooled cross-section, with ϵ_{it} assumed to be independent and identically distributed. This will be the baseline model. To this I will add country controls to tease out any observed differences across countries that affect the level of participation, employment, unemployment or part-time jobs independently from minimum wages in a fixed way. I use year dummies to control for major macro events that affect the levels of market activity in a certain way in all countries.

Following these estimates, I consider the possibility of unobserved country characteristics that may be fixed over time. If such fixed factors exist, there is an omitted variable bias, and I have to consider a composite error term instead, that is:

$$\epsilon_{it} = v_{it} + \nu_i$$

The next step in the choice of model depends on the assumptions about ν_i . I estimate two versions: random effects and fixed effects. While random effects require that ν_i 's to be uncorrelated with X_{it} , fixed effects does not impose this restriction. In the analysis, a simple Hausman test shows fixed effects to be efficient rejecting the null that X_{it} and ν_i 's are uncorrelated. Thus, I report only fixed effects results in the following section.

I am using minimum to median wage ratio instead of the minimum wage variable to reduce the bias arising from correlation between minimum wage levels and macroeconomic events affecting overall wage levels. Current minimum wage also has similar effects but when both current and lagged minimum to median wage ratios are included, the lagged variable explains more of the change in the dependent variables. I only report the regressions with the lagged wage ratio in this version. This seems more appropriate given that in the literature it is shown that employment effects of minimum wages take at least one year to show, since employers will need time to adjust to the changes in the wage levels. This also addresses the concerns about the inability of cross-country analysis to identify the effects of market policies from general economic developments.

3.1 Minimum to Median Wage Ratio and Female Work - Main Model

As the first step, I estimate the most basic model where I only have the lagged minimum wage ratio, male unemployment rate and female fertility and education measures and minimum to median wage ratios interaction with these two socio-demographic characteristic explaining the variation in female labor force participation, employment, unemployment rates, and part-time work incidence. Then I add country fixed effects, or year fixed effects or both country and year fixed effects. Table 3 (on the next page) reports estimation results for all four specifications for all four of the indicators.

The upper right portion of the Table 3 gives the estimation results of these first four specifications for labor force participation rates. Results tell us that as fertility, that is children per mature woman increases in a country, labor force participation rate declines and as more women enrolls in tertiary education as a percentage of men enrolled, participation increases everything else constant. Minimum wage elasticity of labor supply is estimated to be between -0.03 and -0.68. We can think of the negative response of supply to a “price” increase as a sign of increase in number of discouraged workers, as a result of lower demand for low productivity work.

Conditional mean of employment is also lower in countries and years with higher minimum to median wage ratio, that is as the bite of the minimum wage increases everything else constant employment declines. The minimum wage elasticity employment to population ratio is estimated to be between -0.07 and -0.71. In the model specifications where the coefficients are significantly different than zero, higher enrollment and lower fertility rates imply a higher rate of female employment.

The bottom right portion of the third table tells us that the fertility rate is negatively correlated with unemployment and female tertiary school enrollment is positively correlated with unemployment. The direct relationship between minimum wage ratio and unemployment is not significant in any of these four specifications. However, in all models everything else constant a minimum wage with more bite reduces unemployment in countries with high fertility and low enrollment. The relationship with enrollment is harder to explain and unexpected, however the possible positive correlation between employment rates (ratio of employed to labor force or (1-unemployment rate)) and fertility rates has been noted before. Rocha and Fuster (2006) explain this phenomenon by modeling the interaction of fertility timing decisions of women and unemployment rates. Basic idea is that women postpone children during high unemployment periods. The estimated minimum wage elasticity of “labor demand” is between -0.34 and -1.05, or to an 1% increase in minimum to median ratio, employment responds by a 0.34% to 1.05% decline.

Table 3: Female Work and the Minimum Wage to Median Wage Ratio -Basic Model

	Labor Force Participation				Employment			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
lagged minimum to median wage ratio	-1.01 (0.43)*	-1.16 (0.50)*	-1.19 (0.37)**	-0.74 (0.30)*	-0.86 (0.42)*	-0.88 (0.48)+	-1.03 (0.37)**	-0.49 (0.26)+
Prime age male unemployment rate	-0.89 (0.21)**	-0.39 (0.16)*	-0.98 (0.19)**	-0.52 (0.11)**	-1.47 (0.20)**	-0.84 (0.16)**	-1.57 (0.18)**	-0.91 (0.10)**
female tertiary educ enrollment	0.39 (0.19)*	1.01 (0.25)**	0.06 (0.17)	0.10 (0.15)	0.26 (0.18)	0.85 (0.24)**	-0.06 (0.16)	-0.08 (0.13)
fertility	-19.45 (11.56)+	-57.88 (8.06)**	-8.01 (10.19)	-12.32 (5.04)*	-40.31 (11.18)	-40.31 (7.70)**	6.58 (9.93)	5.59 (4.39)
minwage*female tertiary educ enrollment	0.64 (0.23)**	0.97 (0.17)**	0.52 (0.21)*	0.21 (0.11)+	0.42 (0.23)+	0.69 (0.16)**	0.30 (0.20)	-0.08 (0.09)
minwage*fertility	-0.00 (0.00)	-0.02 (0.01)**	0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	-0.02 (0.01)**	0.01 (0.00)*	0.01 (0.00)*
Constant	83.29 (20.74)**	126.76 (24.24)**	63.48 (17.92)**	96.63 (14.25)**	68.21 (20.05)**	106.15 (23.14)**	49.03 (17.47)**	77.34 (12.41)**
Minimum wage elasticity	-0.13	-0.68	-0.03	-0.16	-0.18	-0.71	-0.07	-0.14
Observations	359	359	359	359	359	359	359	359
R-squared	0.23	0.82	0.48	0.94	0.31	0.84	0.53	0.96
country dummies	NO	YES	NO	YES	NO	YES	NO	YES
year dummies	NO	NO	YES	YES	NO	NO	YES	YES

	Unemployment				Share of Part-timers			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
lagged minimum to median wage ratio	-0.15 (0.10)	-0.12 (0.16)	-0.16 (0.10)	-0.15 (0.15)	0.31 (0.55)	0.64 (0.31)*	0.37 (0.59)	0.67 (0.32)*
Prime age male unemployment rate	1.06 (0.05)**	0.76 (0.05)**	1.08 (0.05)**	0.68 (0.06)**	0.26 (0.24)	-0.01 (0.08)	0.33 (0.28)	0.00 (0.11)
female tertiary educ enrollment	0.19 (0.04)**	0.22 (0.08)**	0.21 (0.04)**	0.34 (0.08)**	-0.79 (0.27)**	0.13 (0.14)	-0.85 (0.28)**	0.18 (0.15)
fertility	-23.04 (2.62)**	-19.70 (2.50)**	-24.44 (2.72)**	-25.25 (2.55)**	55.31 (12.87)**	5.01 (7.09)	59.82 (13.85)**	4.89 (7.90)
minwage*female tertiary educ enrollment	0.30 (0.05)**	0.29 (0.05)**	0.33 (0.05)**	0.40 (0.05)**	-0.69 (0.26)**	-0.12 (0.14)	-0.77 (0.28)**	-0.11 (0.15)
minwage*fertility	-0.00 (0.00)**	-0.00 (0.00)**	-0.01 (0.00)**	-0.01 (0.00)**	0.01 (0.01)*	-0.00 (0.00)	0.01 (0.01)**	-0.01 (0.00)+
Constant	22.69 (4.70)**	15.89 (7.51)*	24.46 (4.79)**	17.62 (7.22)*	-15.77 (27.46)	-1.53 (15.47)	-20.02 (29.71)	-2.62 (16.24)
Minimum wage elasticity	0.36	0.55	1.05	0.34	0.30	0.28	0.35	0.20
Observations	359	359	359	359	294	294	294	294
R-squared	0.73	0.88	0.75	0.90	0.25	0.96	0.26	0.96
country dummies	NO	YES	NO	YES	NO	YES	NO	YES
year dummies	NO	NO	YES	YES	NO	NO	YES	YES

In the final portion of this table I report results for the four models where the dependent variable is the share of part-time workers. All 4 specifications consistently report that higher fertility rates are associated with higher share of part-timers. A more binding minimum wage is associated with more part-time jobs, more so in countries with lower education. Estimated elasticities tell us that 1% increase in bite of the minimum wage, will increase part-time jobs by about 0.20 to 0.35%

3.2 Sensitivity to Minimum Wage Rules

As indicated in Table 1, there are differences in minimum wage systems across countries that extend beyond the differences in the minimum to median wage ratios. These differences can potentially affect how the minimum wage levels are related to participation behavior, employment and unemployment rates and part-time incidence. In the data there are three dummy indicators capturing these differences. Table 3(on the next page) gives the coefficient estimates and the minimum wage elasticities for fifth specification I estimate using these variables on minimum wage rules and their interaction with the minimum to median wage levels as additional regressors.

The first difference in minimum wage rules across countries is the way the minimum wage is set. In some countries, minimum wages are set by statute while in others they are bargained over, for example by unions. The analysis shows that everything else constant employment and participation rates are higher and unemployment is lower in countries where minimum wage is not set by statute, but is negotiated. The second dimension of the variation in minimum wage rules is the coverage. If the minimum wage is not national but allowed to vary across regions or industries, everything else constant, participation and employment is lower and unemployment is higher. The third dimension of variation in terms of minimum wage rules is the treatment of youth wages. I include a 0-1 indicator for existence of sub-minimum wages for youth. I include this variable in order to account for the possibility that youth and female workers can be competing with each other especially for entry-level jobs. If there is a sub-minimum wage for youth, their employment can be inhibiting female employment. Results support this claim; a more bite to the minimum wage is negatively correlated with employment and labor force participation, more so when there is a youth sub-minimum wage. This can be seen as possible competition between women and teenagers for minimum wage jobs. Moreover, even though more binding minimum wages are associated with more part-time jobs, this is less so when there is a sub-minimum wage for youth. This too, can be considered as a sign of substitutability of low productivity female work and teenage work. Unemployment decreases with minimum wage but not when there is a sub-minimum wage and female enrollment is low and fertility is high. Estimated minimum wage elasticity of labor supply is 0.2 and minimum wage elasticity of labor demand is -0.53. This means a 1% increase in the minimum to median wage ratio increases unemployment by 0.53%. Fertility is negatively related and enrollment is positively related to labor

force participation and unemployment ratio as they are in previous specifications. Moreover, the association between minimum wages and employment and labor force participation rates is still more negative with higher fertility and lower enrollment.

Table 4: Female Work and the minimum wage to median wage ratio - Sensitivity to the minimum wage Rules				
	Labor force participation	Employment	Unemployment	Part-time jobs
	(5)	(5)	(5)	(5)
lagged minimum to median wage ratio	-1.64 (0.43)**	-1.34 (0.41)**	-0.32 (0.09)**	2.87 (0.56)**
Prime Age Male Unemployment Rate	-0.89 (0.19)**	-1.46 (0.18)**	1.03 (0.04)**	0.38 (0.22)+
female tertiary educ enrollment	0.60 (0.17)**	0.46 (0.16)**	0.20 (0.04)**	-0.08 (0.28)
fertility	-46.58 (11.07)**	-28.92 (10.37)**	-24.13 (2.25)**	85.88 (13.04)**
minwage*female tertiary educ enrollment	1.05 (0.23)**	0.74 (0.22)**	0.40 (0.05)**	-1.67 (0.27)**
minwage*fertility	-0.01 (0.00)*	-0.01 (0.00)+	-0.00 (0.00)**	0.00 (0.01)
minimum is negotiated	82.26 (10.19)**	81.27 (9.54)**	-11.53 (2.07)**	45.63 (12.13)**
minimum is not national	-47.35 (11.04)**	-44.06 (10.35)**	1.61 (2.25)	-8.92 (12.40)
sub-minimum wages for youths	-41.89 (9.23)**	-41.96 (8.65)**	8.09 (1.88)**	-9.68 (8.86)
minwage*minimum is negotiated	1.18 (0.22)**	1.14 (0.20)**	-0.09 (0.04)*	0.22 (0.25)
minwage*subminimum wages for youths	-1.60 (0.20)**	-1.61 (0.19)**	0.28 (0.04)**	-0.98 (0.24)**
minwage*minimum is not national	0.78 (0.16)**	0.80 (0.15)**	-0.17 (0.03)**	0.39 (0.16)*
Minimum wage elasticity	-0.2	-0.24	0.53	0.64
Observations	359	359	359	294
R-squared	0.44	0.53	0.84	0.47
Standard errors in parentheses. * significant at 5% ** significant at 1%				

3.3 Sensitivity to Market Conditions

There are striking differences in the labor market conditions and institutions of countries in the data, which can potentially change the ways and intensity minimum wages affect the work behavior. One can easily see that it is possible for employment effects of minimum wages to be magnified if the country has restrictions on the adjustment of hours and benefits given to employees, making contracts less flexible. However, if there are institutions in place to help the unemployed to find jobs, these frictions in the labor market resulting from minimum wage changes can appear to be higher. Thus, I include measures of labor standards, of strictness of employment protection laws, and active labor

market policies, unemployment insurance replacement rates, and unionization rates into the model. All of these measures are constructed by OECD originally. The measure of strictness of employment protection laws is reevaluated by Neumark and Wascher (2004) to exclude the minimum wages.

	Participation		Employment		Unemployment		Part-time jobs	
	(6)	(7)	(6)	(7)	(6)	(7)	(6)	(7)
lagged min. to median wage ratio	-0.47 (0.53)	-3.81 (0.80)**	-0.54 (0.50)	-3.24 (0.76)**	0.27 (0.13)*	-0.34 (0.28)	-1.56 (0.91)+	-2.09 (0.52)**
Prime Age Male Unemp.Rate	-1.49 (0.16)**	-0.19 (0.14)	-1.93 (0.15)**	-0.66 (0.13)**	0.94 (0.04)**	0.80 (0.05)**	0.08 (0.17)	0.01 (0.08)
female tertiary educ enrollment	0.48 (0.19)*		0.36 (0.18)*		0.17 (0.05)**		0.10 (0.34)	
fertility	-49.14 (10.60)**	-55.70 (8.70)**	-35.07 (10.13)**	-40.31 (8.28)**	-14.48 (2.70)**	-16.33 (3.08)**	-56.32 (19.40)**	-4.37 (7.65)
minwage*female tertiary enroll.	-0.01 (0.00)	0.02 (0.01)*	-0.00 (0.00)	0.02 (0.01)*	-0.00 (0.00)	0.00 (0.00)	-0.01 (0.01)	0.02 (0.01)**
minwage*fertility	0.66 (0.22)**	0.98 (0.18)**	0.48 (0.21)*	0.75 (0.17)**	0.17 (0.06)**	0.20 (0.07)**	1.02 (0.36)**	0.04 (0.14)
minimum is negotiated	44.79 (11.01)**		41.98 (10.52)**		-1.65 (2.80)		4.77 (12.56)	
minimum is not national	-4.65 (13.60)		-14.35 (12.99)		20.78 (3.46)**		-38.73 (14.41)**	
subminimum wages for youths	-1.20 (10.87)		-10.70 (10.39)		16.00 (2.76)**		1.73 (11.12)	
minwage*minimum is negotiated	-0.94 (0.22)**	-0.07 (0.17)	-0.90 (0.21)**	-0.10 (0.16)	0.07 (0.06)	0.07 (0.06)	0.15 (0.25)	-0.19 (0.10)+
minwage*subminimum wages	-0.05 (0.21)	0.18 (0.20)	0.14 (0.20)	0.23 (0.19)	-0.30 (0.05)**	-0.11 (0.07)	0.48 (0.21)*	0.43 (0.11)**
minwage*minimum is not national	0.08 (0.27)	-0.85 (0.28)**	0.30 (0.26)	-0.39 (0.27)	-0.45 (0.07)**	-0.73 (0.10)**	0.89 (0.28)**	0.72 (0.16)**
labor standards	-5.97 (7.23)		-15.76 (6.91)*		18.37 (1.84)**		-23.39 (8.22)**	
unemp insurance replacement rate	16.15 (5.06)**	12.63 (5.88)*	14.87 (4.83)**	12.51 (5.60)*	2.64 (1.29)*	1.98 (2.08)	-3.65 (7.25)	-16.51 (3.42)**
employment protection	7.54 (5.71)		11.43 (5.45)*		-7.20 (1.45)**		-32.87 (7.46)**	
active labor policies	-31.40 (7.34)**		-24.43 (7.01)**		-10.79 (1.87)**		-8.62 (7.49)	
unionization rate	29.22 (5.41)**	-6.41 (5.54)	29.85 (5.17)**	-5.74 (5.28)	-5.02 (1.38)**	-1.02 (1.97)	30.95 (6.37)**	3.95 (3.11)
minwage*labor standards	-0.03 (0.14)	-0.42 (0.11)**	0.18 (0.13)	-0.14 (0.11)	-0.36 (0.04)**	-0.42 (0.04)**	0.64 (0.16)**	0.05 (0.08)
minwage*employment protection	-0.23 (0.11)*	-0.27 (0.10)**	-0.30 (0.11)**	-0.29 (0.09)**	0.15 (0.03)**	0.09 (0.03)*	0.44 (0.15)**	0.08 (0.06)
minwage*active labor policies	0.86 (0.15)**	0.45 (0.16)**	0.71 (0.14)**	0.28 (0.16)+	0.20 (0.04)**	0.25 (0.06)**	0.07 (0.15)	-0.14 (0.09)
minwage*unionization rate	-0.58 (0.11)**	-0.03 (0.11)	-0.59 (0.10)**	-0.05 (0.11)	0.09 (0.03)**	0.04 (0.04)	-0.72 (0.13)**	0.02 (0.06)
minwage*unemp. ins. rep. rate	-0.32 (0.09)**	-0.29 (0.10)**	-0.30 (0.09)**	-0.28 (0.10)**	-0.05 (0.02)*	-0.03 (0.04)	0.15 (0.13)	0.26 (0.06)**
Minimum wage elasticity	-0.12	-0.92	-0.14	-0.61	1.36	2.03	0.87	0.004
Observations	337	337	337	337	337	337	272	272
Number of countries		17		17		17		16
R-squared	0.75	0.67	0.79	0.66	0.89	0.69	0.80	0.40

Standard errors in parentheses. + significant at 10% * significant at 5% ** significant at 1%

There are two different specifications of the models estimated in Table 5 (on the previous page). The first one is the pooled OLS with regulation measures and the interaction of the minimum wage ratio with these market regulation measures added to the regression specifications from Table 4. All of these market flexibility measures are normalized, that is, after being demeaned divided by their standard deviations. Thus, the coefficients on these policy variables can be interpreted as the effect of a one standard deviation change in the associated labor market policies index on either of the market work measure. Moreover, the coefficient on the minimum to median wage ratio is the effect of the minimum wage bite in some hypothetical country with each policy variable equal to its sample average.

The second specification on this table is a panel fixed effects specification. I also allow possibility of lack of correlation between the errors and the regressors and estimate the random effects models. However, Hausman test rejects in all cases the null that X_{it} and ν_i 's are uncorrelated. Thus I report only fixed effects results. Fixed effects regressions cannot estimate coefficients for time invariant variables so only the effects of union density, unemployment insurance replacement rate and the minimum wage interaction with socio-demographic variables, minimum wage setting rule dummies and market regulation variables.

The elasticities calculated with these last two specifications are of same sign as the previous specifications. Minimum wage elasticity of labor supply is estimated to be between -0.12 and -0.92, minimum wage elasticity of employment to population ratio is between -0.14 and -0.61. Estimated elasticity of demand varies ranges from -1.36 to -2.03. Also in these models, share of part-timers increases up to 0.87% as a response to a 1% increase in the bite of the minimum wage even after controlling for differences in market regulations across countries.

The higher the fertility rate is, the lower the employment and participation rates are, as before. Higher fertility rate also goes with lower the unemployment rate, bringing us back to Rocha and Fuster (2006) results. As the bite of the minimum wage increases, employment and labor force participation rate decline less in these countries with high fertility rates. However, unemployment rate increase as a response to an increase in minimum wage bite, more in countries with higher fertility. Employment and labor force participation rates are higher for countries with negotiated minimum wages and countries with national minimum wages. However, having subminimum wages is associated with lower female participation and employment to population rates in all specifications. These results are consistent with the results from the previous specifications.

The models consistently tell us that as the minimum gets more binding, the employment rate and participation rate decline more in countries with more stringent employment protection laws. Active labor market policies, on the other hand, mitigate the disemployment and discouragement effects of minimum wages. Minimum wages also decrease employment and participation rates and increase unemployment rate more in countries with higher unionization rates and higher unemployment ben-

efits. The relationship between the minimum wage, unionization and employment can be seen as a support for the “insiders versus outsiders” argument on the effects of minimum wages. It is also interesting to note that a higher unemployment insurance replacement rate is associated with a higher unemployment rate but less so in a country with a more biting minimum wage.

The following two tables summarize the estimates of the 6th specification (Table 5 column 1 for each dependent variable) at the dimensions of education and fertility and employment protection and labor standards index values. Table 6 is a matrix where the columns are the fertility dimension and rows are the enrollment in tertiary education as a percentage of men. These four cells include countries with above mean and below mean values of the given social empowerment measures for women.

Table 6: Minimum Wage Elasticities by Female Fertility and Enrollment Levels				
	low fertility		high fertility	
low enrollment				
	Belgium	$\epsilon_{participation} = -0.21$	France	$\epsilon_{participation} = 0.04$
	Canada	$\epsilon_{employment} = -0.32$	Great Britain	$\epsilon_{employment} = -0.01$
	Japan	$\epsilon_{unemployment} = 0.64$	Ireland	$\epsilon_{unemployment} = 0.026$
		$\epsilon_{part-time} = -0.54$	Luxembourg	$\epsilon_{part-time} = 1.17$
		$\bar{x}ParticipationRate = 68.3$	Netherlands	$\bar{x}ParticipationRate = 64.7$
		$\bar{x}EmploymentRate = 63.4$	Portugal	$\bar{x}EmploymentRate = 60.1$
		$\bar{x}UnemploymentRate = 7.1$		$\bar{x}UnemploymentRate = 7.2$
		$\bar{x}Part-timeRate = 27.1$		$\bar{x}Part-timeRate = 31.2$
high enrollment				
	Germany	$\epsilon_{participation} = -0.70$	Australia	$\epsilon_{participation} = 0.29$
	Spain	$\epsilon_{employment} = -0.69$	Denmark	$\epsilon_{employment} = 0.30$
	Greece	$\epsilon_{unemployment} = -0.66$	New Zealand	$\epsilon_{unemployment} = 4.55$
	Italy	$\epsilon_{part-time} = 3.29$	Sweden	$\epsilon_{part-time} = -0.26$
		$\bar{x}ParticipationRate = 57.34$	United States	$\bar{x}ParticipationRate = 70.22$
		$\bar{x}EmploymentRate = 50.49$	Portugal	$\bar{x}EmploymentRate = 65.9$
		$\bar{x}UnemploymentRate = 12.11$		$\bar{x}UnemploymentRate = 6.33$
		$\bar{x}Part-timeRate = 21.78$		$\bar{x}Part-timeRate = 26.3$

Reported means and elasticities are means across all countries in a given cell. This table tells us that participation rates and employment rates are highest in countries with high enrollment rates and low high fertility rates and unemployment rates are lowest. These are also the countries where share of part-timers are quite high. In these countries employment and labor force participation is positively associated with minimum wage but so is the unemployment rate. In fact across all cells, this group of countries has the highest minimum wage elasticity of labor demand, with -4.55. That is a 1 % increase in the bite of the minimum wage is associated with a 4.5 % increase in unemployment. High fertility low employment countries have the highest share of part-timers. This is in line with general image of part-time jobs as marginal jobs for high opportunity cost (of work), low productivity workers. Share of part-timers is lower in countries with low fertility and high enrollment rates, but

these countries are also the ones with highest minimum wage elasticity of part-time jobs' share in employment.

Table 7 is similar to Table 6 but has the labor standards index and stringency of employment protection laws as dimensions of variation. Countries are divided as low/high employment protection and as low/high labor standards countries given their position with respect to the means of these indices.

Table 7: Minimum Wage Elasticities by Degree of Labor Market Regulation				
	low employment protection		high employment protection	
low labor standards				
	Canada	$\epsilon_{participation} = -0.03$	Belgium	$\epsilon_{participation} = -0.64$
	Denmark	$\epsilon_{employment} = -0.08$	Portugal	$\epsilon_{employment} = -0.87$
	Great Britain	$\epsilon_{unemployment} = 0.38$		$\epsilon_{unemployment} = -0.04$
	Ireland	$\epsilon_{part-time} = -1.10$		$\epsilon_{part-time} = 2.35$
	Japan	$\bar{x}_{ParticipationRate} = 70.2$		$\bar{x}_{ParticipationRate} = 68.78$
	United States	$\bar{x}_{EmploymentRate} = 65.9$		$\bar{x}_{EmploymentRate} = 62.96$
		$\bar{x}_{UnemploymentRate} = 6.33$		$\bar{x}_{UnemploymentRate} = 8.69$
		$\bar{x}_{Part-timeRate} = 24.9$		$\bar{x}_{Part-timeRate} = 23.46$
high labor standards				
	Australia	$\epsilon_{participation} = 0.42$	Germany	$\epsilon_{participation} = -0.3$
	Luxembourg	$\epsilon_{employment} = 0.53$	Spain	$\epsilon_{employment} = -0.31$
	New Zealand	$\epsilon_{unemployment} = -2.06$	France	$\epsilon_{unemployment} = 3.99$
	Netherlands	$\epsilon_{part-time} = 0.71$	Greece	$\epsilon_{part-time} = 3.23$
		$\bar{x}_{ParticipationRate} = 63.19$	Italy	$\bar{x}_{ParticipationRate} = 65.28$
		$\bar{x}_{EmploymentRate} = 59.86$	Sweden	$\bar{x}_{EmploymentRate} = 58.84$
		$\bar{x}_{UnemploymentRate} = 5.31$		$\bar{x}_{UnemploymentRate} = 10.46$
		$\bar{x}_{Part-timeRate} = 38.2$		$\bar{x}_{Part-timeRate} = 21.83$

According to this table employment and labor force participation is on average higher in countries with low employment protection and low labor standards. Countries with high labor standards and stringent employment protection laws have relatively higher unemployment rates. Unemployment rate increases with minimum wage bite in countries with low employment protection and low labor standards and in countries with high employment protection and high labor standards. Moreover, the highest shares of part-timers are in countries with low employment protection and high labor standards.

4 Conclusions and Future Extensions

This paper provides evidence for the negative correlation between minimum wage to median wage ratio and female labor force participation, and employment. It also shows that countries with higher

minimum wage to median wage ratios have higher unemployment rates and part-time job incidence. The negative effects of minimum wage increases on employment and participation are stronger in countries with lower female tertiary educational enrollment and higher fertility.

This paper also incorporates controls for labor market regulations and minimum wage setting rules. The role that institutions play in shaping the ways the minimum wages affect labor market outcomes has been discussed widely but rarely incorporated in formal analysis. For example, the negative minimum wage effects on employment and participation are stronger in countries with more stringent employment protection laws, and less active labor market policies. This study also shows that the manner the minimum wage is set and its coverage is as important as its level in terms of its effect on female work behavior. The analysis shows that everything else constant employment and participation rates are higher and unemployment is lower in countries where minimum wage is not set by statute, but is negotiated. Furthermore, if there is a subminimum wage for youth, a more bite to the minimum wage is negatively correlated with employment and labor force participation of women, implying a possible competition between women and teenagers for entry level jobs.

With incorporation of gender equality measures as well as characteristics of the labor market institutions in the analysis, this study distinguishes itself from the vast majority of the minimum wage studies and still provides evidence of negative effects on supply of and demand for female work.

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